



Early Journal Content on JSTOR, Free to Anyone in the World

This article is one of nearly 500,000 scholarly works digitized and made freely available to everyone in the world by JSTOR.

Known as the Early Journal Content, this set of works include research articles, news, letters, and other writings published in more than 200 of the oldest leading academic journals. The works date from the mid-seventeenth to the early twentieth centuries.

We encourage people to read and share the Early Journal Content openly and to tell others that this resource exists. People may post this content online or redistribute in any way for non-commercial purposes.

Read more about Early Journal Content at <http://about.jstor.org/participate-jstor/individuals/early-journal-content>.

JSTOR is a digital library of academic journals, books, and primary source objects. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations. JSTOR is part of ITHAKA, a not-for-profit organization that also includes Ithaka S+R and Portico. For more information about JSTOR, please contact support@jstor.org.

SHOULD FORMAL GEOMETRY BE TAUGHT IN THE
ELEMENTARY SCHOOLS? IF SO, TO
WHAT EXTENT?

BY D. J. KELLY.

In appearing before this assembly I feel somewhat like an impostor, for I am not a mathematics teacher nor have I ever been one. Neither do I make any claim as a mathematician but am merely a plain superintendent of schools, somewhat young in experience and a trifle old-fashioned in ideas. As such I speak this afternoon and should you disagree with anything that is said you are at liberty to do so for "my hat is not in the ring" nor have I any fears of "recall."

Since I was asked to speak as a superintendent of schools it seemed best for me not to give my individual opinions and experience alone but rather to stand as the representative of school superintendents as a class and to give you an insight into the general trend of the thought and practice of those who are administering the affairs of our leading schools at the present time. Consequently I prepared a questionnaire and submitted it to representative cities in every section of the United States—from Maine to California—from Maine to Louisiana. I received over a hundred replies which have been the material largely used in this discussion, hence, the voice that now speaks to you is not that of a single prophet crying in the wilderness but rather it is the blending of many voices—a sort of composite made up of the well-modulated tone of the conservative East, the lusty yell of the progressive West, the discordant note of the insurgent Middle West and the gentle murmur of the awakening South.

As is usual in such cases many and varied were the opinions expressed and the testimonies given. Some seemed to misinterpret the intent and purpose of the questionnaire, evidently believing that I had some ulterior purpose in view—possibly to inflict on the schools of this country some new form of persecution or inaugurate a new style of faddism. Some apparently thought that the committee who assigned me this topic did so

for the purpose of testing my sanity and that the school superintendents of this country had been designated as a committee to pass judgment thereon.

Now I disclaim any ulterior intent, for I never meant to suggest or inflict anything cruel, unreasonable or foolish but I was merely seeking the light for the purpose of passing it on to shine over or into this assembly. Furthermore, in considering my questions no superintendent had any right to pose as an alienist and offer expert opinion as to my mental condition. One informed me that the topic was too absurd for discussion and another frankly stated that he thought I must be crazy to take up such a topic. I protest that I am not crazy but rather am clothed in my right mind entirely and that this topic is a most sensible one even for school superintendents to consider.

Before giving you the result of my findings I wish to treat the subject briefly from the more technical or scientific point of view. Those of you, which are doubtless all of you, who have read Dr. Smith's most excellent book, "The Teaching of Elementary Mathematics" have found that the author gives a very illuminating treatment of this very subject which we are now considering and in this treatment we find a summarization of the opinions of various famous psychologists and mathematics teachers on the teaching of geometry in the elementary grades. From these I wish to quote briefly.

Rousseau held that "the elementary concepts of the science of geometry should be acquired in the lower grades but for these pupils it should come by the art of seeing instead of by the art of reasoning." La Croix a leading mathematics teacher of a hundred years ago said, "Of all branches of mathematics geometry is possibly the one which should be understood first. It is a subject well adapted to interest children provided it is presented to them with respect to its applications. The operations of drawing and of measuring cannot fail to be pleasant, leading them to the science of reasoning." Laisant believed "the first notions of geometry should be given a child along with the first notions of algebra following closely upon the beginning of theoretical arithmetic."

As Dr. Smith states these are not the ideas of mere theorists but of practical teachers and these ideas have been carried out with more or less extent in European and American schools.

In this country Professor Hanus worked a course for the seventh and eighth grades of the Cambridge and Boston schools. It began with object teaching and led up to the demonstration of all the simpler propositions. In Germany a course was prepared somewhat similar in scope but neither of these savored very much of Euclid. Some formal demonstrations, however, were introduced as a sort of climax.

In this country at least results could not have been satisfactory, for Boston reports that they now teach no geometry in their elementary schools nor do they believe it desirable. Superintendent Parlin, of Cambridge, says that formal demonstrations should not be taught in the grades, but he does advocate a sort of inspectional form which will lead pupils to discover by inspection much that they will later demonstrate by the usual methods.

I find that Galesburg, Illinois, also had, about forty years ago, a course in geometry in their grades, which was subsequently discontinued.

Nashua, N. H., tried it in the ninth grade about fifteen years ago, but being only partly successful it was dropped. The children's minds seemed too immature to grasp a subject of this kind.

Jersey City has given inventional geometry in the seventh and eighth grades, but dropped it as beyond the comprehension of the children.

The only place I found now having an elementary course in the subject is Indianapolis, which introduces it in the seventh grade. This course is almost wholly of a constructional and practical nature, without any formal demonstrations, unless one could call the answering of questions such.

Concord, N. H., has taught concrete forms from Hornbrook's Concrete Geometry with favorable results. In St. Louis geometric concepts are introduced through arithmetic text-books and in drawing. Auburn, Maine, hopes to include it later. The Des Moines superintendent states that he has had foreign children come into his schools who had had geometry in the grade schools of their native country, but their knowledge was so superficial as to lead one to believe that it is a pedagogical blunder.

On this point of the pupils' ability there seems to be a great difference of opinion.

Dr. Leonard, of New Rochelle, says that there is no question but that children can easily learn the simpler propositions in formal geometry but there is more useful work for them.

Superintendent Shear, of Poughkeepsie, believes that geometry may well be taught in the eighth grade. Children should know certain forms such as lines, angles and polygons. In addition there should be a few simple proofs such as: (1) vertical angles are equal, (2) the sum of the angles on one side of a straight line is equal to two right angles. It does seem to me, if I may venture an opinion, that children can comprehend the demonstration of either of these as easily as they can the computing the rate of income on 40 Chicago, Rock Island and Pacific refunding 4's purchased at 96 $\frac{1}{4}$ or the time in Honolulu when it is sunrise in New York.

In opposition to these views I find a rather formidable array. Yonkers claims that the precise methodical reasoning of formal geometry is too formal for young children. Other places that agree with this testimony are Ithaca, Oswego, Kingston, Albany, Atlanta and Denver.

Oakland, California, believes that below the high school geometry would be almost wholly a memorizing process. Superintendent Tisdale, of Watertown, N. Y., agrees with this and sounds a note of warning. He believes that in substituting memorizing for reasoning the children would get a false start and thus do much harm to their further progress in mathematical studies.

There seems to be a very prevalent opinion that formal geometry has no place in the elementary curriculum for different reasons. Some superintendent, as has already been stated, believes that it could be done, but he regards it as unfeasible. As Superintendent Smith, of Cortland, says, "A boy may be taught to walk on his hands, but there is no reason for it so long as he has good feet." Newton, Massachusetts, says that it might be taught but so might a host of other things.

Other subjects are suggested as giving just as good training besides being of more practical value. Training to think, to reason and to observe could be carried on as well or better in the study of English grammar, arithmetic, science or almost any other subject. In fact a most successful superintendent in one of the best cities educationally in this state claims that formal

geometry is of but little value anywhere in the educational process.

Many superintendents think it impossible because of lack of time. Rochester says that we are attempting too much in the grades and a vast chorus catches up the refrain and sing, "so say we all of us, so say we all." The elementary course is too crowded; our grades are overcrowded; there is no room for anything more; our schools are overloaded; no time for anything more; no more subjects in the elementary course; work should be more concentrated; we now spread out too much; let us concentrate; fewer subjects better taught; etc.; etc.

This may all be true, yet if we can offer something better than we now have should we not do it? We often do attempt too much and do much that is superficial. Leaving out the question of geometry we have to eliminate many things that might be attempted. Aristotle taught us something about the importance of exercising the sense of proportion. President Hyde, of Bowdoin, says that a proper development of this sense is a requisite for a well-balanced teacher. This does not mean though that we are to neglect a good thing just because we are busy. If best to do so take up the new thing and leave out something less important.

Another objection is one that has already been cited, namely, too difficult for the children. In addition to these the lack of suitable text-books and scarcity of properly trained teachers would make the task of introducing formal geometry into the grades impossible. It is true that text-books are wanting, but no teacher is fitted to teach any grade mathematics unless she has had a thorough training in geometry; without it no teacher can get the broad, comprehensive view of arithmetic needed to assign relative values and properly grade the work.

There seems to be a very general call for the constructional or inventional geometry, which one superintendent says is no geometry at all, but for the sake of argument we will call it such. That this is essential there seems to be little reason to doubt.

Even as low as the kindergarten some geometrical facts can be taught and in connection with arithmetic and drawing some geometric terms may be used. Our children must know the shape and names of figures and solids. The construction of squares, triangles and other problems is an interesting and

essential part of drawing. How to measure these figures and the solids is a necessary part of arithmetic. In the industrial work of the higher grades further application could be made.

It is my opinion that in connection with all of this informal work a properly trained and skillful teacher can easily bring in much that is usually regarded as formal with the result of giving the pupil more light, furnishing him valuable information which he may never get providing he does not enter the high school and if he does enter then his interest will be aroused so that high school mathematics will be looked forward to with pleasure and handled with greater ease. In the words of Superintendent Hughes, of this city, "if the teachers knew geometry so well that they could, out of the abundance of their knowledge work in some of the important principles it would be well."

For a general summing up I can do no better than to quote Superintendent Dyer, of Cincinnati: "Concrete or constructive geometry is a valuable part of the elementary mathematics and should be taught with mechanical drawing, wood work and mensuration. In the eighth grade a little formal geometry to give conception of the propositions in mensuration. Propositions of bisecting lines are easily within the comprehension of eighth-grade children. The formal should, however, be kept subsidiary, being included in the arithmetic and not given as a separate course in eighth-grade geometry."

And to the whole discussion I offer the following conclusions:

Informal or constructive geometry should be introduced into the elementary school work, (1) through the course in drawing in practically all grades, (2) through the work in arithmetic more especially in the upper grades, (3) through the manual training or other mechanical work, (4) through the knowledge, experience and skill of the teacher.

Formal geometry should not be introduced as a separate subject. It should be blended with the regular arithmetic of the eighth grade and given as a climax to the informal geometry and also as a prelude to the mathematics of the high school.

In attempting this we must have in mind the interests of the children, for their interests alone should be the end, aim and endeavor of all work in our schools.

ROME, N. Y.